112 cannot communicate with the delivery port due to the closing force imposed by the spring 164.

[0035] If a primary circuit brake failure occurs, the modulation function of the valve 60 comes into play. This is best illustrated in FIG. 8. The control port 124 is still pressurized and the air pressure urged the relay piston 130 toward its lower position. Because of the failure, there is no pressure at the primary port 120. Thus, the pressure at the secondary port 122 moves the modulating piston upwardly as shown. This lifts the modulating end 154 of the piston from its sealed engagement with seal member 162, again establishing communication between the delivery port 114 and the exhaust port. Consequently, the mechanical springs can be applied through selective depression of the foot valve when the primary circuit has failed. This, of course, is a very desirable and beneficial feature of the valve assembly.

[0036] If a failure occurs in the secondary circuit, and the primary circuit is still operative, the rear axle or drive brakes can still be operated. The modulating piston moves downwardly, as shown in FIG. 9, resulting in the supply reservoir pressure being delivered to the spring brakes. However, no modulation occurs since the service brakes are still operative and can satisfy safe stopping distance requirements.

[0037] Another feature incorporated into the valve is generally referred to as anti-compounding (FIG. 10). That is, it is undesirable to apply both the spring brake and the normal service braking at the same time, i.e., compounding the brakes. To prevent this undesired result, an anti-compounding feature is incorporated into the valve assembly. For example, if the vehicle is parked, i.e., there is no air pressure at the control port 124, then air from the primary circuit drives the pistons downwardly by providing pressure to the upper face 172 of the relay piston. The lower end of the modulating piston moves the exhaust valve from its sealed position with the seat and thereby establishes communication between the supply port 112 and the delivery port 114. As will be recognized, this backs the spring brakes from the applied position and prevents compounding of the brake application.

[0038] The valve of FIG. 11 is similar to that shown and described with reference to FIGS. 4-10. It is preferred from the standpoint, however, that a more compact assembly is provided since the intermediate housing portion is removed. Instead, an inner static piston 200 is received in a modified upper housing portion. As will be appreciated, the static piston 200 is sealed relative to the upper housing portion via O-ring seals 202, 204. It has an internal cavity that receives the sliding seals 136' and 140' of the modulating piston. In substantially all other respects, the correspondence between the valve of FIGS. 4-10 and that in FIG. 11 is exhibited through the use of components identified with a primed suffix ('). Accordingly, operation and function of the combined spring brake modulating relay valve of FIG. 11 is the same as described above.

[0039] The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will become apparent to those skilled in the art. It is intended to include all such modifications and alterations insofar as they fall within the scope of the appended claims or the equivalents thereof.

Having thus described the invention, we claim:

1. A combined spring brake modulating relay valve comprising:

a housing having a control port, supply port, delivery port, exhaust port, and a chamber formed therein in selective communication with the supply port adapted to receive pressurized air from an associated reservoir, the delivery port adapted to communicate with associated spring brakes, and the exhaust port adapted to communicate with ambient;

a valve member in the chamber normally biased to preclude communication between the supply and delivery ports and permit communication between the delivery port and the exhaust port;

a first piston assembly received in the housing and movable in response to pressure from the control port;

a second piston received in the housing and operatively associated with the first piston for selective movement relative to the first piston and selective movement with the first piston;

primary and secondary ports communicating with opposite faces of the second piston and communicating with primary and secondary brake circuits so that if both brake circuits are operational, there is no impact on the second piston.

2. The combined valve of claim 1 further comprising an exhaust valve in the housing located for operative engagement with the second piston.

3. The combined valve of claim 1 wherein the second piston and the exhaust valve are normally disposed in spaced relation and engage one another in response to pressure in the control port.

4. The combined valve of claim 3 wherein the second piston and the exhaust valve are spaced form one another when the primary circuit is inoperative.

5. The combined valve of claim 1 wherein in response to failure of the primary brake circuit, there is no pressure on one side of the second piston and the second piston is separated from the exhaust valve permitting pressure from the spring brakes to be modulated and used to control the primary brake circuit.

6. The combined valve of claim 1 wherein in response to failure of the secondary circuit, a greater amount of pressure is supplied to the spring brake.

7. The combined valve of claim 6 wherein the second piston sealingly engages the exhaust valve and urges it further from its seat allowing an increased pressure flow between the supply and delivery ports.

8. The combined valve of claim 1 wherein if the primary and secondary brake circuits are operational, there is no modulation of the pressure at the delivery port.

9. The combined valve of claim 1 further comprising a first spring urging the first piston toward abutting engagement with the second piston.

10. The combined valve of claim 1 further comprising a biasing spring for urging the second piston from disengagement with the exhaust valve.

11. The combined valve of claim 1 further comprising a biasing member operatively associated with the exhaust valve for urging the exhaust toward a seated position to preclude communication between the supply port and the delivery port.